

Appl. No. 09/787,819
Amdt. Dated November 22, 2004
Reply to Office action of May 20, 2004

REMARKS

Reconsideration and allowance in view of the following amendments and remarks are respectfully requested.

Claims 1-2, 4-18, 53-58, 63 and 64 remain in this application. Claims 3 and 21 have been canceled. Claims 19-20, 22-52 and 59-62 have been withdrawn. Claims 1, 7, 10, 11, 15, 16, 53-56 and 58 have been amended. Claim 64 has been added, incorporating a feature from page 1 of the specification. No new matter has been added.

Rejection Under 35 U.S.C. § 112

Claim 2 stands rejected for failing to comply with the enablement requirement of 35 U.S.C. § 112, first paragraph. The Examiner asserts that the specification does not describe or enable one skilled in the art to work the workpiece in a direction that is longitudinal or transverse to a direction of movement of the workpiece while moving the workpiece in an axial direction, with "at least one roll." Applicants disagree and assert that the specification of the present application sufficiently discloses this feature. Figures 7A and 7B show only one roll (16") provided with annular beads moving the workpiece (28) in an axial direction. Note that rolls (16", 16") in the figures are not provided with annular beads. The beads (24) and recesses (26) of the outer profile (22, 22") of roll (16") are arranged inversely to each other, i.e., roughly crosswise. Page 25, paragraphs 1 and 2 of the specification also describe this feature. Furthermore, Figs. 10A and 10B illustrate that only one roll (74") provided with annular beads arranged at an angle to the axial direction is necessary to impose an axial motion to the workpiece, although a second roll (74") follows the first roll (74"). The second roll, however, is only provided to work the workpiece in a direction that is longitudinal or transverse to the direction of movement of the workpiece inverse to the motion caused by the first roll. Thus, by the method according to the present application, the workpiece to be treated is not imposed with a rotation around its longitudinal axis, but only an axial movement (see p. 3, para. 3 and p. 23, para. 4 to p. 24, para. 1). Accordingly, Applicants request that the rejection of claim 2 under 35 U.S.C. § 112, first paragraph, be withdrawn.

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Claims 1, 2, 4-18, 53-58 and 63 stand rejected as indefinite under 35 U.S.C. § 112, second paragraph.

The Examiner asserts that the use of the limitation “and/or” in claims 1, 15, 53-56 and 58 renders the scope of the claims unclear. Applicants have amended these claims to correct this deficiency and therefore request that the rejections be withdrawn.

The Examiner also asserts that the use of the limitations “opposite signs” and “the same sign” renders claims 7, 10 and 11 unclear. Applicants note that pages 19, paragraph 4, page 25, paragraph 2, and Figure 7B of the specification disclose that angles α and α' can differ in their sign such that one is positive and the other is negative. Applicants also note that Figures 8A and 8B show the limitation of claim 11, whereby two rolls are rotating in opposite directions (1 and 2 of Fig. 8A) and each roll has an angle α with the same sign. Applicants have amended these claims to clarify their meaning and therefore request that the rejections be withdrawn.

In the rejection of claim 16 under 35 U.S.C. § 112, second paragraph, the Examiner asserts that the limitations of claim 16 contradict those of claim 15, to which claim 16 is dependent. Applicants have amended claim 16 to depend from claim 14 and therefore request that the rejection be withdrawn.

Rejections Under 35 U.S.C. § 103

Claims 1 and 12-14 stand rejected under 35 U.S.C. § 103(a) as obvious over Braun et al. (U.S. Patent No. 5,179,722) in view of Applicant's Admitted Prior Art (AAPA). The Examiner asserts that Braun et al. discloses a method for surface treatment of workpieces that includes all of the limitations of claim 1 except that the workpiece is aluminum. The Examiner purports to find this teaching in AAPA. In addition, claims 15-17 and 63 stand rejected under 35 U.S.C. § 103(a) as obvious over Braun et al. in view of AAPA and further in view of Tinfow et al. (U.S. Patent No. 3,845,533). The Examiner asserts that Tinfow et al. disclose a workpiece being treated by several rolls powered in a different direction of rotation.

As amended, Applicants assert that claim 1 is not obvious over Braun et al. and AAPA. Claim 1, as amended, includes the limitation that a "workpiece is worked by said at least one roll in sequence in opposite directions" (emphasis added). Applicants submit that the prior art of record does not disclose this limitation. In the method according to the present application, the surface of the workpiece is moved, i.e., displaced, first in one direction with respect to the longitudinal axis by beads and recesses having a first angle which, for example, is positive. The surface of the workpiece is then displaced in the opposite direction by beads and recesses having a second angle which, for example, is negative. This feature is illustrated in Figs. 10A and 12B, where it is illustrated that, the surface of the workpiece is treated by a first pair of rolls (74') having beads and recesses which are arranged parallel to the longitudinal centerline of the workpiece (arrow 28). In these figures, with respect to the direction of the motion of the workpiece, at the location where beads are arranged at the first roll, recesses are arranged at the second roll, and at the location where the recesses are arranged at the first roll, beads are arranged at the second roll. With this arrangement, the surface of the workpiece will be first displaced by each bead of the first roll partly to the right side and partly to the left side into the adjacent recesses at the right and left of each bead. Subsequently, the displaced surface of workpiece will be re-displaced by each bead of the second roll partly to the left side and partly to the right side into the adjacent recesses at the left and the right of each bead.

This same effect could be obtained by the second pair of rolls (74'') having beads and recesses which are arranged at a first (positive) angle and a second (negative) angle to the longitudinal centerline of the workpiece (arrow 28), or vice versa, as illustrated in Fig. 10A. In this embodiment, however, the surface of the workpiece is displaced firstly from the right edge of the workpiece to the left edge by the beads and recesses of first roll (74'') and then from the left edge to the right edge by the beads and recesses of the second roll (74').

The treatment of the surface of the workpiece by the first pair of rolls (74') and the second pair of rolls (74''), one after the other, is only one option. It is also possible to work the surface of workpiece with only one of these pairs of rolls (74' or 74''). Either of these treatments will

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have the same effect of increasing the strength and hardness of the workpiece. The treatments illustrated in Figs. 1 to 8B are also applicable to workpieces having a round surface or bore. Applicants submit that, in a fair reading of Braun et al., Tinfow et al. and AAPA, the Examiner cannot possibly conclude that the limitations of claim 1, as amended, are disclosed or suggested. In particular, Applicants assert that the prior art of record does not disclose or suggest a workpiece that is worked in sequence in opposite directions by at least one roll with an outer profile having the form of annular beads and recesses.

In view of these arguments and the amendment to claim 1, Applicants assert that claim 1 is patentable over the prior art of record, and Applicants request that the rejection of claim 1 over the Braun et al./AAPA combination be withdrawn. Claims 12-17 and 63 are dependent on claim 1 and incorporate all of its limitations. Applicants submit that AAPA and Tinfow et al. do not remedy the deficiencies of Braun et al. discussed above. Accordingly, as Applicants assert that claim 1 is allowable, Applicants request that the rejection of these claims be withdrawn.

Claims 1, 2, 4, 6-11, 18, 53, 54, 58 and 63 stand rejected under 35 U.S.C. § 103(a) as obvious over AAPA in view of Abramsen (U.S. Patent No. 4,185,484). The Examiner asserts that AAPA teaches that it is known to surface treat workpieces of aluminum and/or alloyed aluminum in which the workpiece is worked at least in part including exposing a treated surface of the workpiece to compressive stresses. The Examiner purports to find the remaining limitations of these claims in Abramsen.

Applicants assert that claim 1, as amended, is patentable over the AAPA/Abramsen combination. Claim 1, as amended, is directed to a method for the surface treatment of workpieces and includes the limitation that the “workpiece is worked by said at least one roll in sequence in opposite directions.” Applicants submit that neither AAPA nor Abramsen discloses or suggests this limitation, and, in particular, the limitation that the workpiece is worked in sequence in opposite directions.

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The backing rolls (26, 28) of Abramsen impose only a pressure force upon the work rolls (22, 24). Thus, the vector of the work rolls is essentially vertical and perpendicular to the longitudinal axis of the workpiece. Accordingly, no displacement of the surface of the workpiece to the side is caused by the backing rolls or the work rolls. Even if tensile stresses were created by the method of Abramsen, it would not be possible to work the surface in a continuous, selectable or reproducible manner. Even if the trace imposed by the rugulose surface of upper work roll (22) and the trace imposed by the rugulose surface of lower work roll (24) were adjacent to each other and fully covered the surface of the workpiece, a homogeneous surface would not be created on the workpiece. This is because both of the traces would be created on their own, causing stress peaks of an undesirable height at the left and right edges of each trace. These stress peaks would not increase the strength and hardness of the workpiece, but would actually reduce its strength and hardness. Treatment of a workpiece according to the method of claim 1 will eliminate these stress peaks, displacing stress in the workpiece to the edges of the workpiece itself, where stress peaks will always exist.

The mechanism described above can be further illustrated as it is applied to a flat surface. If the workpiece with one flat surface is not subjected to longitudinal movement, the surface of the workpiece is worked from a first end to a second end, and then from the second end back to the first end. For example, a bulb is exposed on the surface which is pushed or driven or perhaps kneaded from the first end of the workpiece to the second end, and then back to the first end. Now, if the workpiece is exposed to a movement in the longitudinal direction, the surface treatment consequently has to be carried out in a lateral transverse direction in order to achieve such displacement. Accordingly, such displacement would not be possible in a direction that is longitudinal or transverse to the direction of movement of the workpiece which is in sequence in opposite directions. The workpiece can only be worked in one direction, but not subsequently in two directions being opposite to each other. Such treatment or working, respectively, of the workpiece is much more difficult to describe for a workpiece having a round surface or at least

one bore, but takes place in the same way as in the case of a workpiece having at least one flat surface.

As discussed, a feature of the method according to the present application is that the surface of the workpiece is continuously treated or worked in total, so that no stress breakdown or stress peaks will occur. That means that each roll provided at least in part with an outer profile is treating or working the surface of the workpiece across the whole area of the workpiece.

In contrast, the method of Abramsen only teaches that a trace of the surface is treated or worked by one (upper) roll and other trace of the surface is treated or worked by a second (lower) roll. The traces do not supplement each other and therefore the workpiece is not treated or worked in total. Even if the traces were to partially overlap each other, the surface of the workpiece has regions which are untreated or unworked.

Moreover, the method of Abramsen differs in the essential way that even if both traces supplement each other, the bounds of the traces have been exposed with undesired stress peaks, which does not result in a uniform distribution of stresses across the whole surface. The workpiece is then rather provided with spiral stress peaks across its length, so that the advantageous material properties of the workpiece (i.e., strengthening and hardening of the workpiece), cannot be achieved at all.

To summarize the differences between the method of the present application and the method of Abramsen:

- Abramsen describes an apparatus for frictionally engaging the surface of the workpiece. In the present invention, no frictional engagement is taught, but, on the contrary, a surface treatment is carried out.
- Abramsen describes a cross-rolling unit with rolls having concave surfaces. In the present invention a cross-rolling unit is not provided. The rolls are rather engaged linearly at the cylindrical or on the flat surface of the workpiece.

- The apparatus according to Abramsen for frictional engagement is used for descaling and for exercising deformation by pressure as well as for making a spiral movement. The pressure is exposed on the workpiece in an orthogonal direction to spread away the mill scale therefrom. As a result, the method of Abramsen is not able to simultaneously eliminate surface defects to thus avoid crack propagation caused thereby. The method according to the present invention is based on a change of the structure resulting in ring hardness of the workpiece across its entire surface.
- In the apparatus according to Abramsen the workpiece is moved spirally or in lines. In the present invention the workpiece is only moved in lines.

An important feature of the present application is thus that the at least one roll moves the surface of the workpiece (and not the workpiece itself) back-and-forth in order to remove stress lines and increase its strength and hardness. Such a back-and-forth movement, i.e., movement in sequence in opposite directions, is, however, not taught by Abramsen.

Accordingly, for the reasons stated above, Applicants assert that the AAPA/Abramsen combination does not disclose or suggest all elements of claim 1 as amended, and Applicants request that this rejection be withdrawn.

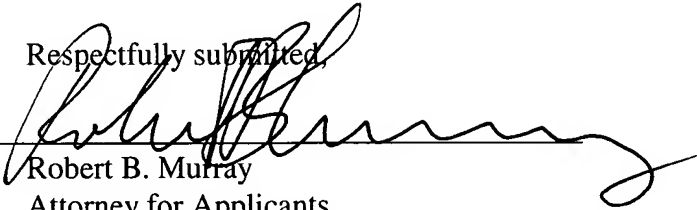
Claims 2, 4, 6-11, 18, 53, 54, 58 and 63 are dependent on claim 1 and incorporate all of its limitations. As Applicants assert that claim 1 is in a condition for allowance, Applicants request that the rejections of these claims be withdrawn.

Claims 5 and 54-57 stand rejected under 35 U.S.C. § 103(a) as obvious over AAPA in view of Abramsen and further in view of either McQueen (U.S. Patent No. 5,460,563), Russell (U.S. Patent No. 6,062,645), Shiau (U.S. Patent No. 4,640,500) or Fredrick (U.S. Patent No. 5,671,976). These claims are all dependent on claim 1 and incorporate all of its limitations. Furthermore, none of these references disclose or suggest the limitations of amended claim 1. As

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Applicants assert that claim 1 is in a condition for allowance, Applicants request that the rejections of these claims be withdrawn.

Accordingly, Applicants respectfully request that a timely Notice of Allowance be issued in this case.

Respectfully submitted,
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